

National Aeronautics and
Space Administration
Headquarters
Washington, DC 20546-0001



Reply to Attn of:

Q

FEB 12 1998

TO: Marshall Space Flight Center
Attn: DA01/Acting Director

FROM: Q/Associate Administrator for
Safety and Mission Assurance

SUBJECT: Final Process Verification (PV) Report for Marshall Space
Flight Center (MSFC)

As documented in the Agreement for Safety and Mission Assurance (SMA) for the Human Exploration and Development of Space Enterprise, NASA-wide PV reviews are being conducted at each NASA Field Center by the Office of Safety and Mission Assurance (OSMA). The purpose of these reviews is to assess the effectiveness and efficiency of SMA processes and management practices being implemented at each Field Center. Results from the PV reviews will be used by OSMA to verify the stability and capability of the safety, reliability, and quality assurance functions at each NASA Field Center. The final report for the PV review conducted at MSFC December 1-4, 1997, is enclosed.

The PV review team appreciates the support and courtesy extended by MSFC staff during the visit. This cooperative effort has established a viable benchmark for future evaluations of SMA operations and processes being implemented at MSFC.

If you have any questions or comments regarding our review of the SMA function at MSFC, please feel free to call at any time. You may also contact the MSFC PV Chairman, Mr. Roger Mielec, at (202) 358-0575 if you have any questions or comments concerning the report.


Frederick D. Gregory

Enclosure

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Process Verification Final Report
for
Marshall Space Flight Center

January 26, 1998

Introduction

A series of NASA-wide Process Verification (PV) reviews are being conducted by teams from the Office of Safety and Mission Assurance (OSMA), NASA Headquarters. The purpose of these reviews is to assess the effectiveness, efficiency, and stability of safety and mission assurance (SMA) management practices being implemented at each Field Center. The Marshall Space Flight Center (MSFC) review was conducted, December 1-4, 1997. Members of the Process Verification team were:

| | |
|--------------------------------------|---|
| Chairperson: | Roger Mielec (Code QE) |
| Deputy Chairperson: | Ron Moyer (QE) |
| Team 1, S&MA Management: | Roger Mielec (Code QE); Ron Moyer (QE) |
| Team 2, Functional Assurance: | Jon Mullin (Code QS); Art Lee (Code QS) |
| Team 3, Mission Assurance: | Phil Napala (Code QE); Ben Caroccio (JSC/SAIC/Hazard Analysis) |
| Observer: | Siamak Yassini (ARC/IV&V/Software). |

Summary

An out-briefing was presented to the MSFC Center Director, Dr. Wayne Little on December 4, 1997. PV evaluation sheets, written by the team, were grouped into one of four categories which require different levels of review (SMA Director, Center Director, Enterprise, and None). Thirty-one evaluation sheets were written. Nineteen items from the 31 evaluation sheets were designated by the SMA Director and PV Chairperson to be briefed to the Center Director for his familiarization and review. These are as follows:

1. With the advent of new NASA/cooperative partner relationships, the Enterprise should take on the responsibility to formalize safety and mission assurance insight/oversight processes for these new accelerated programs. Appropriate SMA insight/oversight contract language should then be incorporated in to Requests for Proposals and contracts. (Evaluation Sheet Number MSOMA02)
2. There is evidence, i.e., self assessments, internal audits, of excellent preparation for the upcoming ISO 9000 third party certification. A pre-assessment of MSFC by the ISO registrar appeared positive. (MSSMA01)

Enclosure

3. Customer satisfaction is very high with SMA products and services, i.e., hazard and safety analyses. (MSSMA03)
4. Establishment of a Quality Management Council indicates an upper management level of commitment at MSFC. (MSOMA04)
5. The SMA hazard analysis process is mature and receives NASA-wide respect. (MSOMA05)
6. There was no evidence of a Center master list of all current programs and projects for use in assessing SMA risk and prioritization. (At the out-brief, the Center Director indicated that the MSFC financial office had a list.) (MSSMA09)
7. There is no sustained staffing and funding to provide early and in-depth software assurance coverage of MSFC projects. MSFC SMA usually becomes involved during initial testing; at times, software planning and development of hazard analyses progresses without SMA input. (MSSMA08)
8. For accelerated or cooperative partnership programs, if the mechanism to gain NASA SMA insight/oversight is the task agreement, then the agreements should be negotiated very early in the program. For the Reusable Launch Vehicle (RLV) Technology Program (X-33) program, SMA negotiations appear to have been delayed. Some insight is gained when the NASA partner hires NASA personnel to perform very specific tasks. (MSSMA08)
9. MSFC emergency preparedness personnel have not attended the NASA-wide emergency preparedness meetings and training seminars for two years. (MSOFA02)
10. Since the last visit, MSFC has established a well equipped and functional Emergency Operations Center. The effort in improving the emergency preparedness response program is noteworthy. (MSOFA02)
11. There is strong evidence of close coordination with MSFC emergency preparedness managers, the Industrial Safety Office, and the MSFC response community. (MSOFA03)
12. Although draft MSFC Procedures and Guidelines (MPG) 1700.1 have not been finalized, the pressure vessels and pressurized systems (PV/S) program is effectively being worked among the Industrial Safety Office, Facilities Office, and the support contractor (Teledyne Brown Engineering). (MSOFA10)
13. Again, although draft MPG 1700.1 has not been finalized, the "lock-out/tag-out" program is effectively being worked between the Industrial Safety Office and the Facilities Office with inspections of the MSFC contractors to comply with OSHA requirements. (MSOFA12)
14. The MSFC Industrial Safety Office and the Environmental Health Office are to be commended for an excellent, well managed confined space program. This is a well balanced and well executed program. Interface with the U.S. Army Redstone Arsenal Fire Department is also excellent. (MSOFA13)

15. The Facilities Office continues to effectively maintain and update the facilities drawings throughout MSFC. A system is being developed by the Facilities Office to assure that maintenance and repair changes to the MSFC facilities are reported and tracked in a timely manner so that timely configuration changes can be made. (MSOFA14)
16. A MSFC document should be developed that establishes the configuration management and control responsibilities for institutional operations. This should be different from the Science and Engineering Directorate and programs containing less stringent requirements. (MSOFA14)
17. MSFC has established and follows the safety variance policy in draft MPG 1700.1. (MSOFA15)
18. A Centerwide policy needs to be written on procedures for waivers and deviations. (MSOFA15)
19. Close coordination and management controls exist between the Facilities Office and the Industrial Safety Office on the MSFC lifting devices and equipment program. An inventory is planned that will verify configuration management and control of existing lifting devices and equipment. (MSOFA16)

The remaining evaluations sheets were designated for the SMA Director's level of review and were not briefed to the Center Director at the out-brief. This procedure is left up to the SMA Director; but, for a few PV's to date, the Center Director has asked to be briefed on those items assigned for the SMA Director's review. These designated items are typically under the SMA Director's authority for any type of disposition deemed necessary. The PV team is mandated not to approve nor sign-off on any corrective actions. As such, OSMA does not keep a tracking log for corrective actions but will review available PV information in preparation for succeeding PV's.

Evaluation sheets written by the PV team were further subdivided as containing strengths of the SMA organization and/or containing barriers to the SMA organization performing its mission. Some evaluation sheets contained both strengths and barriers for a specified SMA process being verified. For the MSFC PV, 22 strengths and 11 barriers were detailed. During a PV, an SMA organization's strengths and barriers are reflective of how the SMA organization functions according to the processes described in its Annual Operating Agreement (AOA). Accordingly, Center SMA organizations are not compared to other Center SMA organizations.

For those evaluations assigned to the SMA Director's level of review, ten evaluations were deemed strengths of the SMA organization and four were categorized as barriers and accepted for resolution by the SMA Director. These four barriers at the SMA Director's level included:

1. For the X-33, a Memorandum of Agreement (MOA) has been drafted between MSFC SMA and Dryden Flight Research Center (DFRC) SMA to support flight safety. The draft MOA should be expedited, with the support of the MSFC X-33 Program Manager, to enable DFRC SMA to proceed with their safety analysis in an official capacity. DFRC SMA involvement has not been fully recognized by the industry partner. (MSSMA06)
2. MSFC SMA has the NASA responsibility for X-33 Safety, Reliability, Maintainability, and Quality Assurance (SRM&QA) functions and tasks. Other Centers are performing SRM&QA functions and tasks without coordination with MSFC SMA. This stems from task agreements that the industry partner has with the other Centers. Consideration should be given to notifying all Centers that MSFC SMA is the office of primary responsibility for X-33 SRM&QA. Closer coordination with the industry partner on task agreements is also an option. (MSSMA07)
3. Planning should begin to meet NASA's safety obligation on international agreements for orbital debris. SMA, as a minimum, should have insight to orbital debris models, risk outcomes, and risk goals for applicable programs/projects. (MSOMA01)
4. All "high hazard areas" are not being inspected as required by 29 CFR 1960.25. (MSOFA01)

MSFC SMA PV planning started several months before the actual PV with a negotiated date for the PV. This was followed-up with trips by the OSMA Chairperson to review a draft of the MSFC SMA Annual Operating Agreement (AOA), which contained all MSFC SMA processes, and to negotiate the set of processes to be included in the PV. Programs/projects were also selected whereby the customer, i.e., Program/Project Managers (International Space Station, nodes and payloads; Space Shuttle Main Engine (SSME); Solid Rocket Booster (SRB); Advanced X-ray Astrophysics Facility (AXAF); Reusable Launch Vehicle (RLV) Technology Program (X-33)) were to be interviewed about the products and services provided by the SMA organization. X-33 top level program management personnel encountered last minute schedule conflicts and were not interviewed, but information was obtained from other program personnel and the SMA point of contact.

The actual Process Verification progressed according to the agenda. After brief introductory remarks (Monday afternoon), team members conducted the PV (subjective conformance management review of the SMA organization) via interviews and minimal

documentation review. This took two days (Tuesday and Wednesday). A change did occur whereby the out-briefing to the Center Director was moved, at his request, from Friday to late Thursday. Thursday morning was dedicated to verifying that observations were correct, going over the accuracy of written descriptions, completing the simple PV evaluation sheets, reviewing the evaluation sheets as a team, and finally discussing the evaluation sheets with the SMA Director. The out-briefing was finalized Thursday afternoon and given to the SMA Director prior to the out-brief. On the evaluation sheet, the "level" at which "further review was needed" (SMA Director, Center Director, Enterprise, or None) was determined by the PV Chairperson and the SMA Director. Those 19 items judged to require attention beyond the SMA Director, were out-briefed to the Center Director on Thursday afternoon.

Center Review Results

The PV team concluded that:

1. The Marshall Space Flight Center Safety and Mission Assurance organization continues to maintain insight/oversight of institutional Safety, Reliability, Maintainability and Quality Assurance (SRM&QA) and provides valued support to programs/projects. An X-33 NASA integrated SMA plan for insight/oversight should be developed.
2. Customer satisfaction is very high. ISS (nodes and payloads), SSME, SRB, and AXAF program/project managers were interviewed. For X-33, personnel within the program management office were interviewed.
3. The management of the SMA support contractor, Hernandez Engineering, Incorporated (HEI), is effective via the written tasks orders, reviews, and very close coordination. HEI deliverables are known in advance and delivered in a timely manner.
4. The Enterprise should ensure a procedure that considers NASA SMA insight/oversight contract language for new partnership or accelerated programs.
5. SMA contribution to ISO 9000 third party certification shows a serious commitment to supporting the Center via documentation of procedures, internal audits, automation of schedules and events, internal SMA training, internal audits, and proactive procedures to ISO 9000 lessons learned by other Centers.
6. SMA software assurance, typically, begins with initial testing; it should begin earlier during planning and development of safety hazards.

7. A written MSFC policy for waivers/deviations is needed to define the Center's management position on the waiver/deviation of either MSFC, NASA, or Federal standards and regulations.
8. A MSFC policy is required to establish the Configuration Management (CM) and control responsibilities for institutional operations (facilities, safety, environmental engineering and management, management operations). The policy should have less stringent requirements than the existing CM policy for the Science and Engineering Directorate and programs.
9. The draft MSFC Safety Manual, MPG 1700.1 should be finalized as soon as possible to establish official policies for all MSFC programs.
10. MSFC emergency preparedness personnel have not attended agency emergency preparedness meetings and training seminars for the previous two years due to funding constraints.
11. The MSFC fire protection program requires the updated locations and quantities of all hazardous materials to be included in the "pre-fire plan." Particular focus must be placed on the licensing process for sites where explosives, including propellants, are handled, stored or used. Also, the U.S. Army Redstone Arsenal Assistant Fire Chief stated that NASA MSFC has not paid its current bill for fire protection services.
12. SMA must continue to be the "lead in the assurance function" as the authority having jurisdiction to assure that an integrated "explosives safety program" is in place at MSFC.

Review Metrics

A central concept of process verification is minimum intrusion into the SMA organization's operations. One of the PV metrics is the amount of Center SMA effort required to prepare for the review. Another PV metric is the amount of Center SMA effort consumed during the PV. Ideally, there should be no extra preparation required; however, the reality is that some minimum planning is needed. For the first PV at MSFC, it was estimated that 4 MSFC SMA person-days were expended preparing for the PV and that 8 MSFC SMA person-days were required during the PV.

SUMMARY OF MSFC PV EVALUATION SHEETS

| Number | Level of Review: | | | Strength | Barrier | Remarks |
|----------|------------------|--------|------------|----------|---------|---|
| | SMA | Center | Enterprise | | | |
| MSSMA01* | | X | | X | | ISO 9000 certification |
| MSSMA02 | | X | | X | | Customer satisfaction |
| MSSMA03 | X | | | X | | MSFC SMA home page |
| MSSMA04 | X | | | X | | Gov't Mandatory Inspection Points |
| MSSMA05 | | X | | | X | Need SMA task agreements written early |
| MSSMA06 | X | | | | X | Expedite X-33 MSFC and DFRC SMA MOA |
| MSSMA07 | X | | | | X | Notice, MSFC SMA is OPR for X-33 NASA SMA |
| MSSMA08 | | X | | | X | Need early software assurance |
| MSSMA09 | | X | | | X | Master list of programs for risk assessment |
| MSOMA01 | X | | | | X | Orbital debris safety |
| MSOMA02 | | | X | | X | SMA contract language on partnership programs |
| MSOMA03 | X | | | X | | Strong risk assessment capability |
| MSOMA04 | | X | | X | | Centerwide involvement in Quality Council |
| MSOMA05 | X | | | X | | Electronic hazard and CIL data base |
| MSOMA06 | | X | | X | | Very good hazard analysis procedures |
| MSOFA01 | X | | | X | X | Operational safety management |
| MSOFA02 | | X | | X | X | Emergency preparedness |
| MSOFA03 | | X | | X | | Fire protection |
| MSOFA04 | X | | | X | | Safety training and awareness |
| MSOFA05 | | X | | - | - | Explosive safety |
| MSOFA06 | X | | | - | - | Mishap reporting |
| MSOFA07 | X | | | X | | Laboratory safety |
| MSOFA08 | X | | | X | | Annual Operating Agreement |
| MSOFA09 | X | | | X | | Process safety management of chemicals |
| MSOFA10 | | X | | X | | Pressure vessel safety program |
| MSOFA11 | X | | | X | | Hazardous communication program |
| MSOFA12 | | X | | X | | Lock-out/tag-out program |
| MSOFA13 | | X | | X | | Confined space program |
| MSOFA14 | | X | | X | X | Configuration Management program |
| MSOFA15 | | X | | X | X | Deviation/waiver policy |
| MSOFA16 | | X | | X | | Lifting devices and equipment |

* SS - Two digit code for Center

SMA - Three digit code for Safety and Mission Assurance Management Core Function

OMS - Three digit code for Mission Assurance Core Function

OFA - Three digit code for Functional Assurance Core Function

01-99 - Two digit sequential numbering of evaluation sheets in each Core Function



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4, 1997

FACILITY: MSFC

MSSMA01

TEAM MEMBERS: Ron Moyer, Roger Mielec

DESCRIPTION OF PROCESS: SMA Management

ISO 9000 planning and Centerwide support in conducting internal audits and overall implementation.

STRENGTHS: MSFC SMA is the office of primary responsibility for seven elements of ISO 9000. SMA documentation down to Level 4 Organizational Work Instructions have been completed. There are approximately 100 SMA personnel assigned to MSFC. About 12 have taken the five day Lead Auditor training; about 46 have taken the three day Auditor training; 19 people took a two day introductory class; and all remaining SMA personnel have taken the two hour training. SMA has been providing Centerwide expertise and guidance (four and a half SMA FTE's) in several rounds of internal audits in preparation for final assessment and registration scheduled for February 1998. This has included posting of ISO scope, status, document master lists; internal audit schedules, status and results; and flow diagram of MSFC Centerwide Corrective Action System on the MSFC SMA home page. Overall, the ISO registrar (during the pre-assessment in October 1997) concluded that they were confident MSFC could meet the February 1998 deadline with current level of effort.

BARRIERS:

AREAS FOR IMPROVEMENT: Recommend planning begin to form an organizational structure to support and maintain post ISO 9000 third party certification audits and subsequent required documentation (registrar has stated that most post-registration failures occur in the first six months due to reduction of effort after initial registration).

FURTHER REVIEW BY: ☐ SMA INTERNAL ☒ CENTER ☐ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4, 1997

FACILITY: MSFC

MSSMA02

TEAM MEMBERS: Ron Moyer, Roger Mielec

DESCRIPTION OF PROCESS: SMA Management

Customer satisfaction with support and products provided to customer in accomplishing MSFC's mission.

STRENGTHS: SMA customers that were interviewed rated SMA products and services very high. Quality, timeliness, knowledge, accuracy, and professionalism were typical traits. Products included hazard analyses, evaluations and assessments in support of milestones and meetings. Customers sampled were program managers and included the following sample: ISS Independent Assessment, SSME, SRB, ISS Nodes, ISS payloads, and AXAF.

BARRIERS:

AREAS FOR IMPROVEMENT:

FURTHER REVIEW BY: ☐ SMA INTERNAL ☒ CENTER ☐ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4, 1997

FACILITY: MSFC

MSSMA03

TEAM MEMBERS: Ron Moyer, Roger Mielec

DESCRIPTION OF PROCESS: SMA Management

The MSFC SMA home page, which was primarily developed by the support contractor with NASA oversight, contains many standard items and items that are accessed frequently.

STRENGTHS: The MSFC SMA home page is extensive, well written and was verified by the PV team as very useful. During interviews with SMA personnel, they would often access information on the home page. Its contents include ISO 9000 status/procedures/audit results, SMA policy and procedures documents, and DCMC general information. The home page is a vehicle for customer surveys and evaluation of the SMA support contractor.

BARRIERS:

AREAS FOR IMPROVEMENT:

FURTHER REVIEW BY: ☒ SMA INTERNAL ☐ CENTER ☐ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4, 1997

FACILITY: MSFC

MSSMA04

TEAM MEMBERS: Ron Moyer, Roger Mielec

DESCRIPTION OF PROCESS: SMA Management

Government Mandatory Inspection Point (GMIP) reduction. MSFC is under a mandate to reduce Space Shuttle Program GMIPs. The contractors are taking on this responsibility. GMIP reduction metrics are presented at the HEDS Assurance Board meetings.

STRENGTHS: GMIP reduction is progressing on schedule. The least critical GMIPs are being eliminated initially. Critical GMIPs are planned for elimination near the end of the schedule.

BARRIERS:

AREAS FOR IMPROVEMENT: As GMIPs are being eliminated, it is recommended that continuous reviews take place near the end of the GMIP schedule. This involves the more critical GMIPs. This was also echoed by the SSME Project Manager.

FURTHER REVIEW BY: ☒ SMA INTERNAL ☐ CENTER ☐ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4, 1997

FACILITY: MSFC

MSSMA05

TEAM MEMBERS: Ron Moyer, Roger Mielec

DESCRIPTION OF PROCESS: SMA Management

MSFC SMA is the NASA office of primary responsibility for X-33 SMA. This is a Cooperative Agreement Program in partnership with NASA and Lockheed Martin. The development schedule has been compressed.

STRENGTHS:

BARRIERS: The X-33 SMA top-down insight role may have to be negotiated via task agreements (TA's) with the NASA industry partner. Current NASA SMA insight (bottom-up) is typically limited through the TA's in very specific areas, whereby NASA is hired by the industry partner to perform the specific task. (For the DFRC PV, the DFRC X-33 Program Manager stated that early in the program, NASA had written an X-33 SMA task agreement but it was rejected by the industry partner.)

AREAS FOR IMPROVEMENT: For future cooperative agreement, partnership, or accelerated programs, if task agreements become the vehicle to gain insight/oversight, then they need to be written very early and more thoroughly to ensure SMA visibility (insight/oversight).

FURTHER REVIEW BY: ☐ SMA INTERNAL ☒ CENTER ☐ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4, 1997

FACILITY: MSFC

MSSMA06

TEAM MEMBERS: Ron Moyer, Roger Mielec

DESCRIPTION OF PROCESS: SMA Management

MSFC SMA has developed a draft X-33 memorandum of agreement (MOA) with DFRC SMA to support a DFRC safety review for flight at DFRC. MSFC SMA is the office of primary responsibility for NASA X-33 SMA.

STRENGTHS:

BARRIERS: The MSFC and DFRC draft X-33 MOA to support flight safety should be expedited. This will enable DFRC safety to proceed with their X-33 safety analysis and attend meetings as a recognized member. Their involvement has not been fully recognized by the industry partner.

AREAS FOR IMPROVEMENT: Recommend that MSFC SMA, in the draft MOA, detail those X-33 SMA tasks, if any, which MSFC SMA will perform to support X-33 flight safety. The draft MOA currently resembles a task order to DFRC SMA. Recommend MSFC SMA continue to track the progress of MOA through the various offices at each of the Centers and continue to work with the MSFC X-33 Project Office to implement the MOA.

FURTHER REVIEW BY: ☒ SMA INTERNAL ☐ CENTER ☐ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4, 1997

FACILITY: MSFC

MSSMA07

TEAM MEMBERS: Ron Moyer, Roger Mielec

DESCRIPTION OF PROCESS: SMA Management

MSFC SMA Office is the NASA office of primary (OPR) responsibility for X-33 SMA.

STRENGTHS:

BARRIERS: MSFC SMA has the NASA responsibility for X-33 SRM&QA functions and tasks. Other NASA Centers are performing SRM&QA functions and tasks without coordination with MSFC SMA. This stems from the task agreements that the X-33 industry partner has established with the various NASA Centers.

AREAS FOR IMPROVEMENT: All Centers should be notified that MSFC SMA has NASA SMA OPR responsibility and that coordination with the MSFC X-33 Program Office and SMA is required when subject tasks are being performed. Coordination with the partner on the entire set of task agreements or on "SMA only" task agreements is an option.

FURTHER REVIEW BY: ☒ SMA INTERNAL ☐ CENTER ☐ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4, 1997

FACILITY: MSFC

MSSMA08

TEAM MEMBERS: Siamak Yassini

DESCRIPTION OF PROCESS: SMA Management

Early software assurance (safety and quality) coverage of existing projects during planning and hazard analysis phases.

Reference Aerospace Safety Advisory Panel (ASAP) recommendation #35 in the 1996 annual report: "The HQ OSMA should examine the depth of the software assurance process at each Center and promulgate NASA-wide standards for adequate coverage."

References: NASA-STD-2201-93, Software Assurance
NASA-STD-8719-13A, Software Safety

STRENGTHS:

BARRIERS: There is no sustained staffing and funding to provide early and in-depth software coverage of MSFC projects, i.e., planning, approving software hazard analyses, and assuring software quality. At times, contractors develop software assurance and MSFC SMA support begins with the initial testing.

AREAS FOR IMPROVEMENT:

1. Review requirements for SMA staffing to ensure that adequate skills are available to perform software safety and quality tasks on projects.
2. Ensure early involvement of software assurance per requirements.
3. Recommend updating MSFC CQ 5330.1
4. HQ/Code Q has developed Annual Operating Agreement (AOA) draft guidelines for Center comments. The guidelines include software.

FURTHER REVIEW BY: ☐ SMA INTERNAL ☒ CENTER ☐ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4, 1997

FACILITY: MSFC

MSSMA09

TEAM MEMBERS: Ron Moyer, Roger Mielec

DESCRIPTION OF PROCESS: SMA Management

Center master list of current programs and projects for SMA risk management and prioritization.

STRENGTHS:

BARRIERS: During the PV interviews, it was evident that a master list of programs and projects could not be identified which could be used to rank risk and/or prioritize new and upcoming MSFC programs and projects. Program and project offices currently identify new programs, but the process appears unstructured and has some inherent delays.

AREAS FOR IMPROVEMENT: Recommend a method or search for an existing method which is capable of reliably surfacing new Center programs and projects which could be reviewed by SMA to prioritize the envisioned level of effort and identify candidate programs and projects for risk management. This could assist in refining AOA levels of effort for certain SMA processes.

FURTHER REVIEW BY: ☐ SMA INTERNAL ☒ CENTER ☐ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4,1997

FACILITY: MSFC

MSOMA01

TEAM MEMBERS: Phil Napala

DESCRIPTION OF PROCESS: Mission Assurance

NSS 1740.14, Guidelines for Assessing and Procedures for Limiting Orbital Debris. Center SMA organizations, as a minimum, are to have orbital debris safety insight for applicable programs.

STRENGTHS:

BARRIERS: Planning should begin to meet NASA's safety obligation of international agreements for orbital debris. Knowledge of models, risk outcomes, and risk goals is needed.

AREAS FOR IMPROVEMENT: Recommend establishing an SMA point of contact to implement debris safety guidelines and/or have insight to orbital debris risks.

FURTHER REVIEW BY: ☒ SMA INTERNAL ☐ CENTER ☐ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4, 1997

FACILITY: MSFC

MSOMA02

TEAM MEMBERS: Phil Napala

DESCRIPTION OF PROCESS: Mission Assurance

SMA insight/oversight of developmental partnership, cooperative, or accelerated programs.

STRENGTHS:

BARRIERS: With the advent of new NASA/cooperative partner relationships, new safety and mission assurance oversight/insight processes need to be defined. Initial effort should be in developing oversight/insight contract language for RFP/contract incorporation.

AREAS FOR IMPROVEMENT: Enterprise and Center support for the development of above contract language is needed/recommended for successful implementation of SMA on these new types of programs and projects.

FURTHER REVIEW BY: ☐ SMA INTERNAL ☐ CENTER ☒ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4, 1997

FACILITY: MSFC

MSOMA03

TEAM MEMBERS: Phil Napala

DESCRIPTION OF PROCESS: Mission Assurance
SMA risk assessment and analytical support to projects.

STRENGTHS: The Systems Safety and Reliability Office (CR10) provides a very strong central risk assessment analytical capability. As NASA explores new approaches to better manage risks, many of the sound processes developed by the MSFC SMA and project teams can be used as the Center's standard best practices for risk management. Some examples include SMA modeling, risk for flight hardware, and simulation modeling. MSFC's risk assessment capability is widely respected.

BARRIERS:

AREAS FOR IMPROVEMENT:

FURTHER REVIEW BY: ☒ SMA INTERNAL ☐ CENTER ☐ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4, 1997

FACILITY: MSFC

MSOMA04

TEAM MEMBERS: Phil Napala

DESCRIPTION OF PROCESS: Mission Assurance
Marshall Space Flight Center Quality Management Council, quality assurance management.

STRENGTHS: Center top management support is demonstrated by the establishment of the MSFC Quality Management Council. Mandatory attendance by top Center individuals shows organizational commitment in developing a strong quality management system. Leadership is evident in making quality a Centerwide process.

BARRIERS:

AREAS FOR IMPROVEMENT:

FURTHER REVIEW BY: ☐ SMA INTERNAL ☒ CENTER ☐ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4,1997

FACILITY: MSFC

MSOMA05

TEAM MEMBERS: Ben Coroccio

DESCRIPTION OF PROCESS: Mission Assurance

Hazard analysis, electronic data base. Hazard analysis in support of safety was identified as the MSFC SMA number one priority during AOA training provided by Modern Technology Corporation. It was therefore selected for verification.

STRENGTHS: Currently, there is a new electronic hazard and critical items list (CIL) data base which is under development. The data base is to provide a Centerwide sharing and review of hazards and CILs; this will improve the current method of review which largely depends on manual tasks.

BARRIERS:

AREAS FOR IMPROVEMENT:

FURTHER REVIEW BY: ☒ SMA INTERNAL ☐ CENTER ☐ ENTERPRISE ☐ NONE



PROCESS VERIFICATION EVALUATION SHEET

DATE OF REVIEW: Dec 1-4, 1997

FACILITY: MSFC

MSOMA06

TEAM MEMBERS: Ben Coroccio

DESCRIPTION OF PROCESS: Mission Assurance

Hazard analysis. Hazard analysis in support of safety was identified as the MSFC SMA number one priority during AOA training provided by Modern Technology Cororation. It was therefore selected for verification.

STRENGTHS: Process documents are well defined on hazard analysis procedures and guidance. The PV team verified the existence of an efficient and well established process for hazard analysis review via face-to-face meetings and weekly telecons.

BARRIERS:

AREAS FOR IMPROVEMENT: Recommend review of hazard analysis staffing for planned peak workload periods; also cross-training may be an option. Also, it is recommended to continuously review impacts to AOA FTE estimates affecting the hazard analysis process.

FURTHER REVIEW BY: ☐ SMA INTERNAL ☒ CENTER ☐ ENTERPRISE ☐ NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA01

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Jon Mullin

DESCRIPTION OF PROCESS:

SAFETY MANAGEMENT: OSHA 29 CFR 1960, NHB. 1700.1 (V1-B), NHB. 2710

The Marshall Space Flight Center (MSFC) Operational Safety Program has significantly increased its capability and enhanced performance since the NASA Headquarters Functional Management Spot Check of July 17-21, 1995. In 1997, the MSFC primary areas of emphasis were safety consulting with customers requests; managing the review and approval processes; promoting line management and staff awareness; and conducting safety surveys, inspections, and assessments.

"Special areas of emphasis" in safety management accomplishments and ongoing activity included development of MPG 1700.1 "MSFC Industrial Procedures and Guidelines" document, developing the Job Safety Analysis program, institutionalizing office work instructions and processes, the developing of metrics, enhancing safety management with the new CR20-action tracking log, and the publicizing and use of the MSFC hazard reporting through the "Safety Concerns Reporting System (SCARS) Program."

These primary areas of Center safety activities were well managed and controlled, based on verbal verification and documentation during the "process verification." It was noted that safety management has more closely worked with Center supervisors and employees and with union representation.

Safety managers continued to ensure safety compliance with an impressive 29 CFR 1960 program:

1. Follow-up of mandatory inspections is being accomplished very effectively (29 CFR 1960.30).
2. All work areas and operations are being inspected annually (29 CFR 1960.25); however, high hazard areas are not being inspected more frequently as required by OSHA.
3. Inspectors use OSHA guidelines and checklists during inspections.
4. Notices of unsafe working conditions are being provided to Safety Coordinators for posting (29 CFR 1960.26).
5. Approximately 300 hazard abatement plans are awaiting closure throughout the Center. This represents a 50% reduction from the previous visit and a noteworthy improvement.

MSFC safety managers and work center supervisors should continue to work closely for prompt closure of the "300 hazard abatement plans" to help ensure that the government provides a "safe and healthful workplace" for all MSFC employees. The impressive 50% reduction in the numbers of "hazard abatement plans" is due to continued MSFC senior management attention and to a growing and pro-active safety program.

STRENGTHS: The installation has a growing and pro-active safety program.

BARRIERS: All "high hazard areas" are not being inspected as required by OSHA, 29 CFR 1960.25. OSHA requires that "more frequent inspections shall be conducted in all workplaces where there is an increased risk of accident, injury, or illness due to the nature of the work being performed."

Recommendation: The Industrial Safety Office is in need of filling three authorized safety specialist positions with qualified people. These vacancies constitute 25% of the authorized personnel and have existed for over two years. The addition of these personnel can contribute significantly to the accomplishments of OSHA inspection requirements and mishap prevention.

AREAS FOR IMPROVEMENT: None.

FURTHER REVIEW BY: X SMA INTERNAL CENTER ENTERPRSE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA02

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Jon Mullin

DESCRIPTION OF PROCESS: Emergency Preparedness Program

The Emergency Preparedness (EP) Program at MSFC has excellent senior management support. This is evident from an expanded Emergency Operations Center (EOC) and a comprehensive emergency warning system to meet response requirements for all threat conditions. The requirements addressing all-hazard preparedness are specified in Executive Order 12656, "Assignment of Emergency Preparedness Responsibilities", NPD 8710.1, "NASA Emergency Preparedness Program," the "NASA Emergency Preparedness Plan," 29 CFR 1910.38, "Emergency Action Plans," and 29 CFR 1910.120, "Hazardous Waste and Emergency Response."

Areas requiring continued MSFC senior management attention are as follows:

1. Approve the "MSFC Emergency Preparedness (EP) Plan," MPG 1040.3F.
2. Train and exercise with the "emergency response team" and MSFC leadership.
3. Coordinate with the US Army Redstone Arsenal Fire Department to ensure integrated center and host Emergency Preparedness Program effectiveness.

Recommendation: MSFC senior management should continue to endorse, integrate, and lead the MSFC Emergency Preparedness Program to fulfill the Federal and NASA requirements. Emergency planners must continue the noteworthy development of the Center's Emergency Information System and IFMCAD-Integrator System to assist in the emergency management process.

STRENGTHS: Since the previous visit, the Center has established a well equipped and functional Emergency Operations Center that serves MSFC needs. The effort in improving the Emergency Preparedness Response program by senior facilities management and the emergency management team is noteworthy.

BARRIERS: Issue: MSFC emergency preparedness personnel have not attended the annual agency Emergency Preparedness meetings and training seminars for the previous two years due to funding. Non attendance at these meetings results in lost training opportunities and face-to-face program discussions.

Recommendation: MSFC emergency preparedness personnel should budget for and attend meetings regularly to obtain the latest training, technology, and “cross talk information” from other NASA installation emergency preparedness program personnel.

AREAS OF IMPROVEMENT: None.

FURTHER REVIEW BY: SMA INTERNAL X CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA03

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Jon Mullin

DESCRIPTION OF PROCESS: The Fire Protection Program is managed by the Industrial Safety Office (ISO) at MSFC. The NASA program is lead by Dennis Davis. Fire inspection of facilities is conducted in conjunction with the annual OSHA inspections conducted by the ISO staff. Monthly inspections are also conducted by the safety coordinators/safety monitors for each facility. Fire extinguishers are checked by the safety monitors; and if found to be non-compliant, are sent to the facilities group. The facilities group replaces the extinguisher with a new one and sends the old one out for service. Fire suppression is supplied by the U.S. Army Redstone Arsenal which has four stations; a station in the middle of the NASA facilities (Rideout Road - main station), at the airfield, at the army test stands, and near the army housing area. The Fire Department is well equipped and staffed by the army with state certification of all personnel. The fire department has exceptional hazardous materials and confined space response capabilities. The station operates with 2 shifts (24 hours on/24 hours off) with a staff of 44. There is a very good relationship with the MSFC ISO group.

Issue: Currently the U.S. Army is considering the closure of one of the fire stations that serves the MSFC. Senior SMA officials have been in coordination with the army to ensure that the "level of protection" afforded the MSFC employees are not degraded.

Recommendation: Senior SMA, ISO, and the MSFC Facilities Office must continue to work in close coordination with the U.S. Army to insure appropriate medical and fire response times and fire fighting capabilities are continued. NASA needs to ensure that U.S. Army decisions are in consonance with NASA requirements.

STRENGTHS: There is strong evidence of close coordination with MSFC emergency preparedness managers, ISO, and the MSFC response community.

BARRIERS: None.

AREAS FOR IMPROVEMENTS: During the interview with the Assistant Fire Chief, US Army, it was learned that NASA has not paid the current bill for fire protection. This issue was brought to the attention of MSFC Facilities Office. Additionally, all locations and quantities of hazardous materials must be updated on "pre-fire plans." Particular focus should be on the licensing and siting of explosives and propellants storage and handling locations.

FURTHER REVIEW BY: SMA INTERNAL X CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA04

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Jon Mullin

DESCRIPTION OF PROCESS: Safety Training and Awareness Program

MSFC is aggressively using the NASA Safety Training Center for the training of SMA and project personnel. Fifteen classes have been requested for FY 98. Safety campaigns such as "Buckle Up America," OSHA Guest Speaker Program, Safety and Health Fair, Safety Awareness Day, and seasonal programs are used effectively to communicate mishap prevention. "Standardized safety presentations" to the major organizations and population of MSFC provide excellent awareness of the individual organization's safety performance and promotes greater awareness for mishap prevention effort.

STRENGTHS: MSFC has one of NASA's most pro-active "Safety Awareness Programs."

BARRIERS: None.

AREAS FOR IMPROVEMENTS: Issue: One area that requires attention is the need for all managers to attend "Manager Safety Training" in accordance with 29 CFR 1960.54&55. NASA Headquarters, (Code QS) and the NASA Safety Training Center have provided lesson plans to the NASA Centers for the tailoring and implementation of this program.

Recommendation: MSFC should tailor the lesson plans provided "Manager Safety Training" and incorporate these into the "standardized safety presentations" as a method of reaching all required personnel.

FURTHER REVIEW BY: X SMA INTERNAL CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA05

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Jon Mullin

DESCRIPTION OF PROCESS: Explosives Safety

Issue: MSFC safety staff needs to continue to baseline their current explosives safety program against the requirements of NSS 1740.12, "NASA Safety Standard for Explosives, Propellants and Pyrotechnics." The concept of "test zone" safety coverage oversight and test team integration of safety is working well, however, the entire program oversight of MSFC handling, transportation, and storage with integration into the U.S. Army Redstone Arsenal activities is needed to assure a comprehensive and effective explosives safety program. This issue was noted in the spot check of 1995, however, the project has not yet been fully documented and integrated as a program.

Recommendation: The MSFC safety staff, as the designated MSFC authority having jurisdiction for explosives safety (normally the designated Operational Safety Manager), in conjunction with the Redstone Arsenal explosives safety staff and all MSFC managers and users, should execute a comprehensive review of the "integrated life cycle" for explosives at MSFC. This review must include all handling, storage, transport, and use of explosives with all aspects of the explosive's use from arrival onto the Center to the final use and disposal of each explosive item. The review should include all procedures, training, fire protection, technical data, certifications of equipment, and storage facilities. The review should focus on high value hardware and personnel safety. The effects of electro-magnetic source interference on the handling of explosives should also be part of the review. To assist in this effort, Code QS has tasked the NASA Safety Training Center to produce "base explosives safety maps" to assist the MSFC in documenting licensed and sited areas, clear zones, etc.

STRENGTHS: None.

BARRIERS: None.

AREAS FOR IMPROVEMENTS: SMA must continue to be aggressive in pursuing the program as the authority having jurisdiction, to assure that an integrated "explosives safety program" is in place at the Marshall Space Flight Center.

FURTHER REVIEW BY: SMA INTERNAL X CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA06

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Jon Mullin

DESCRIPTION OF PROCESS: Mishap Reporting

The MSFC Mishap Reporting and Corrective Action System is in the process of transition to the Incident Reporting Information System (IRIS). MSFC contributed to the system design requirements and continues to make valuable contribution to the enhancement of the system. The reporting process is up-to-date and is one of the best managed incident reporting programs reviewed in all of NASA. Code QS will assist in providing additional systems training via "train the trainer" as additional center requirements are identified.

STRENGTHS: None.

BARRIERS: None.

AREAS FOR IMPROVEMENT: Issue: A spot check of major mishap corrective action folders revealed that the Government has not provided the latest follow-up on corrective actions for timely case documentation. Additionally, there was no evidence of lessons learned being generated from the mishaps to help preclude similar mishaps at other NASA facilities.

Recommendation: Review each of the open major mishap corrective action folders at least quarterly and advise senior management of the corrective actions taken. Additionally, ensure that lessons learned are generated and provided to the NASA lessons learned program in accordance with NHB 1700.1 paragraph 1012, "Lessons Learned."

Issue: To date, all IRIS system operational issues have been resolved through daily communication with the Headquarters system administrator. This "real time communication" has provided the needed immediate solutions to any problems.

Recommendation: MSFC should identify training requirements that are not currently provided for in IRIS guidance or resolved in technical conversations with NASA Headquarters. The Center should notify Code QS of any serious concerns so attention can be focused towards the establishment of an agencywide formal IRIS training program.

Issue: The MSFC safety staff continues to use creative management methods for ensuring the timely reporting of mishaps, a function which should be performed by the injured employee and their immediate supervisor.

Recommendation: MSFC supervisors and employees must report all mishaps to the Industrial Safety Office in a timely manner. Immediate notification action will help to ensure proper investigation and will aid in the prevention of similar mishaps.

FURTHER REVIEW BY: X SMA INTERNAL CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA07

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Jon Mullin

DESCRIPTION OF PROCESS: Laboratory Safety

The Environmental Health group manages the laboratory safety program. The group is supported by Alfredo J. Teran and Associates, Inc. (AJT) through a support contract with Kelsey-Seybold. The Chemical Hygiene Plan for MSFC is contained within MM 1845.2. This document is a "blueprint" which has provisions (mandates) for each individual laboratory to insert specific information on its operations. A courtesy visit revealed that the Environmental Health Office and the Industrial Safety Office are working closely and well.

STRENGTHS: AJT, the new contractor, was very interested in supporting the Marshall Safety and Health Committee; sharing joint inspections; and participating in mishap notifications, training programs, and emergency response activities. The Industrial Safety Office should continue to actively coordinate with the Environmental Health Office to prove proper "safety and health" programs for MSFC employees.

BARRIERS: None.

AREAS FOR IMPROVEMENT: None.

FURTHER REVIEW BY: X SMA INTERNAL CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA08

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Jon Mullin and Art Lee

DESCRIPTION OF PROCESS: Annual Operating Agreement

During the review of functions for which SMA has "oversight," it was noted that many of the functional areas outside of SMA were not aware of the Annual Operating Agreement (AOA) process. Examples of areas include: the Facilities Office, which has resources committed to Emergency Preparedness, Lifting Standard, and Pressure Vessels, the Environmental Health Programs Office, and the U.S. Army Fire Department for fire protection programs.

STRENGTHS: The Annual Operating Agreement for safety appeared to be comprehensive.

BARRIERS: None.

AREAS FOR IMPROVEMENT: Although the SMA AOA apparently did not indicate resources dedicated to supporting the entire Center program, it may be appropriate for SMA to formally coordinate the plan with those MSFC functions and offices that do the "formal program" for which SMA has an oversight function.

Recommendation: Coordinate all AOAs with appropriate MSFC divisions, functions, and offices to which SMA has interface to assure a well integrated input to the agreement.

FURTHER REVIEW BY: X SMA INTERNAL CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA09

DATE OF REVIEW: December 2, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Arthur Lee

DESCRIPTION OF PROCESS: OSHA Standard 1910.119, "Process Safety Management (PSM) of Highly Hazardous Chemicals" requires organizations to provide for well controlled means for preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals. This standard applies to processes that involve chemicals at or above the threshold quantities (listed in Appendix A of the OSHA Standard) or flammable liquids or gases at one location in quantities of 10,000 pounds or more as stated in the OSHA Standard. A review of the chemicals and flammable liquids and gases used at MSFC and their respective quantities found that none of the specified conditions exist. None of the chemicals at MSFC were found in quantities that meet or exceed the specified threshold, and no flammable liquids or gases at any one location in the amount of 10,000 pounds or more. As a NASA Headquarters, Code QS Functional Management Review (FMR) "Spot Check" recommendation in July 1995, it was requested that MSFC prepare a formal system analysis report that covers all processes using highly hazardous chemicals or flammable liquids or gases and identifies the quantities involved, even though they were found to be under the threshold limits. This report was to document MSFC awareness of the PSM requirements and the Center's compliance with the OSHA standard.

STRENGTHS: MSFC assessment/evaluation process of the Center's operations and activities with the PSM list of highly hazardous chemicals to determine OSHA compliance has been formally documented. This was submitted to NASA Headquarters, Code QS on October 1995. This written documentation satisfies the PSM requirements. It should be noted that continued monitoring of new NASA Programs and Projects that are scheduled at MSFC in the future for PSM compliance is needed to continue OSHA Program compliance.

BARRIERS: None.

AREAS FOR IMPROVEMENT: None.

FURTHER REVIEW BY: X SMA INTERNAL CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA10

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Arthur Lee

DESCRIPTION OF PROCESS: MSFC has a comprehensive pressure vessels and pressurized systems (PV/S) safety program in accordance with NMI 1710.3D, "Safety Program for Pressure Vessels and Pressurized Systems." The PV/S safety program at MSFC is managed by Code AB41 (Engineering Division) and their staff support contractor, Teledyne Brown Engineering (TBE), with Code CR20 (Industrial Safety Office) providing Program oversight. The designated Pressure System (PS) Manager at MSFC is assigned to Code AB41. The draft MSFC Procedures and Guidelines (MPG) 1700.1, Section 5-8, "Pressure Systems" describes the MSFC safety program and policies for PV/S. This has been reviewed by the various MSFC organizations that are responsible for PV/S, and is part of the overall MSFC Safety Manual which is awaiting final MPG approval. This policy will help the MSFC Pressure System Committee to assure the proper certification/recertification (CERT/RECERT) of all PV/S. There are approximately 390 PV/S that are part of the inventory at MSFC. These 390 include PV/S from Michoud Assembly Facility (MAF) and Santa Susanna Field Laboratory (SSFL). An excellent Configuration Management (CM) Program for high pressure PV/S exists at MSFC with required approval by the Configuration Control Board (CCB) prior to any changes can be made. The PV/S drawings have been automated into a data base with a hard copy in a central file which are closely managed by TBE.

MSFC provides continual PV/S safety program oversight for their off-site locations (Michoud Assembly Facility and Santa Susanna Field Laboratory). All PV/S drawings and CERT/RECERT updates for MSFC off-site locations are kept at their respective locations.

Per recommendation by NASA Headquarters, Code QS Functional Management Review (FMR) of July 17-21, 1995, MSFC needed to finalize the MSFC safety program document for PV/S as soon as possible so to have an up-to-date written policy and procedure for CERT/RECERT Program. This was to also include inspection, maintenance, training, etc. to meet the requirements of NMI 1710.3D. Once the document is finalized, MSFC is to assure that this updated document is being provided to the MSFC off-site locations.

In addition, there are no inventory records this includes flexible hoses at MSFC as required by NMI 1710.3D. This was addressed as a problem during the last NASA Headquarters, Code QS FMR Spot Check of July 17-21, 1995. It was recommended that MSFC establish a system to track, inspect, test, and properly tag all flexible hoses as

required by NMI 1710.3D and following the guidelines of NHB 1700.6, "Guide for In-Service Inspections of Ground-Based Pressure Vessels and Systems".

STRENGTHS: Although the MPG 1700.1 has not been finalized, the MSFC PV/S Program is effectively being worked among the Industrial Safety Office, Facilities Office, and the support contractor, TBE.

BARRIERS: None.

AREAS FOR IMPROVEMENT: Although there have been changes since the last NASA Headquarters, Code QS FMR Spot Check of July 17-21, 1995 of the draft MSFC PV/S Program and Policies which is being converted from an individual MSFC Instruction to be part of the overall MSFC safety document, this needs to be finalized as soon as possible to have an official MSFC policy for PV/S as well as reflect the most current MSFC safety program for pressurized system.

Currently, TBE maintains a record of the flexible hoses that are controlled by them, but there are other hoses at other MSFC sites that have not been identified. All flexible hoses at MSFC need to be accounted and inventoried to meet NMI 1710. 3D requirements.

Based on the review of the current draft of the MPG 1700.1, Section 5.8 – Pressure Systems, there needs to be a discussion at the upcoming Pressure System Safety (PSS) Committee meeting to address the Committee's function, process, and procedures at MSFC. Current documentation on its mission and function is very limited.

FURTHER REVIEW BY: SMA INTERNAL X CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA11

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Arthur Lee

DESCRIPTION OF PROCESS: The Hazardous Communication (HAZCOM) Program at MSFC is administered by the Environmental Health Office (EHO). This group is contractor manned through a support contract with AJT and Associates, which is a subcontract to Kelsey-Seybold. Training is conducted by EHO and documented in the employees medical files (civil servant) or given to the employee for their files (contractor). The general populace at MSFC has a good knowledge of HAZCOM issues.

From the previous NASA Headquarters, Code QS Functional Management Review (FMR) "Spot Check" in July 1995, it was recommended that the on-going HAZCOM training needs to continue be provided for all personnel throughout MSFC and not for a limited group of personnel. Integration of the HAZCOM Program with the Redstone Arsenal Fire Department, and the Emergency Preparedness Program (EPP) should be reviewed. The Security Group should be thoroughly trained in HAZCOM and first responder issues due to their response to emergencies at MSFC. In most instances, the Security Group will be the first to arrive at an emergency incident.

STRENGTHS: The overall HAZCOM Program at MSFC has been effectively managed by the EHO. Since the previous FMR "Spot Check" in July 1995, HAZCOM training has been provided to the MSFC Security Group as well as being integrated with the MSFC EPP and Redstone Arsenal Fire Department.

Due to recent changes of MSFC contractor support of several key operational functions such as the Security Group, HAZCOM training needs to be provided to the new employees.

BARRIERS: None.

AREAS FOR IMPROVEMENT: None.

FURTHER REVIEW BY: X SMA INTERNAL CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA12

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Arthur Lee

DESCRIPTION OF PROCESS: From the previous NASA Headquarters, Code QS Functional Management Review (FMR) "Spot Check" in July 1995, there was no MSFC formal written policy for the "lock-out/tag-out (LO/TO) program. There was an informal policy which was being taught at MSFC and to be incorporated into the new consolidated MSFC Safety Handbook. The Contractor "LO/TO" Plans for MSFC had been reviewed by the Industrial Safety Office (Code CR-20). Specific LO/TO tags and locks are available from store stock. Policy requires that an unauthorized removal of a lock or tag is to be investigated as a close call mishap. Training is conducted by the NASA Safety Training Center (NSTC) through MSFC, Code CR-20 and documented in the employee personnel files.

From the previous Functional Management "Spot Check" in July 1995, it was recommended that the formal policy for the "lock-out/tag-out" program at MSFC should be finalized as soon as possible.

STRENGTHS: Although the MPG 1700.1 has not been finalized, the "lock-out/tag-out" program is effectively being worked between the Industrial Safety Office and Facilities Office with inspections of the MSFC contractors to comply with OSHA requirements.

BARRIERS: None.

AREAS FOR IMPROVEMENT: MSFC lock-out/tag-out policies are being converted from an independent MSFC instruction to become part of the overall MSFC safety document. This conversion needs to be finalized as soon as possible to have an official MSFC policy as well as reflect the most current MSFC safety program for lock-out/tag-out.

FURTHER REVIEW BY: SMA INTERNAL X CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA13

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Arthur Lee

DESCRIPTION OF PROCESS: The Confined Space (CS) Program at MSFC is administered by the Environmental Health Office (EHO). This group is supported by AJT and associates, a subcontract to Kelsey-Seybold. The MSFC safety policy for confined spaces is identified in the draft MSFC Procedures and Guidelines (MPG) 1700.1, Section 5-5, "Confined Spaces" with the Confined Space Program defined within MM 1845.3, "Confined Space Entry Program." Required permits for confined spaces are issued by either the Industrial Safety Office (ISO), the Environmental Health Office (EHO), and through the previous MSFC contractor safety representatives (BAMSI). Entrants are required to have an approved confined space plan (approval from ISO and EHO) and have the Redstone Arsenal Fire Department review the confined space for rescue purposes. If the Redstone Fire Department cannot support a rescue, then the entrant must provide engineered rescue capabilities. The EHO at MSFC performs initial monitoring of the space and then turns that responsibility over to the entrant. Training is conducted by EHO and documented in the employees' medical files (civil servant) or given to the employee for their files (contractor). The Confined Space Program at MSFC is in full compliance with the 1993 Federal Policy. The users of confined spaces are responsible for identification, permitting, monitoring, and non-entry rescue. MSFC areas of concern include the small contractor groups who are either unaware of the requirements or choose to ignore them.

STRENGTHS: The MSFC Industrial Safety Office and Environmental Health Office are to be commended for an excellent, well managed Confined Space Program. This is a well balanced and well executed program. Interface with the Redstone Arsenal Fire Department is also excellent.

BARRIERS: None.

AREAS FOR IMPROVEMENT: Due to the recent change of the MSFC support contractor from BAMSI to EG&G, the previous contractor function of confined space permitting needs to be carefully reviewed by ISO and EHO with the new contractor to assure continued CS Program effectiveness.

FURTHER REVIEW BY: SMA INTERNAL X CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA14

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Arthur Lee

DESCRIPTION OF PROCESS: The Configuration Management (CM) of all MSFC facilities drawings and changes is coordinated through Code AB41 (Mechanical & Electrical Branch) within the Facilities Office. There is a very good CM Program for facilities drawings with a historical file that dates back over 30 years. There is an internal Facilities Office standard operating procedure (SOP) for CM and Control of facilities drawings is in place for any changes and updates to be made.

Although there is a MSFC Policy for the CM of MSFC Programs and Projects (MSFC-P04-2, MSFC Standard Procedures EL-31) which relates to Flight Hardware and Equipment, there is no MSFC document that assigns the responsibilities for Institutional Program CM and Control. This policy should include, but not be limited to assignment of roles and responsibilities for: Facilities, Safety, Environmental Engineering and Management, Management Operations, Environmental Health, etc.

From the previous Functional Management Review "Spot Check" in July 1995, a recommendation was made to assure that updates to facilities drawings resulting from facilities maintenance and/or repairs to MSFC buildings and facilities are documented. Previously, when facilities maintenance and/or repairs were performed on MSFC buildings and facilities, there had been instances where changes/updates to facilities drawings were incomplete and resulted in difficulties to obtain the most up-to-date drawings and documentation.

STRENGTHS: The Facilities Office continues to effectively maintain and update the facilities drawings throughout MSFC. The CM Manager for Facilities Drawings is part of Code AB41 (Mechanical & Electrical Team) within the Facilities Office. The CM Manager approves of all changes prior to any changes that can be made to the drawings.

The Facilities Office is developing a system to assure maintenance and repair changes to the MSFC facilities are reported and documented properly and the work is completed in timely manner.

BARRIERS: There needs to be a MSFC document (either a MSFC Instruction or part of the MSFC Safety Manual) to establish the CM and Control responsibilities for the Institutional Operations. This should be different from the Science and Engineering Directorate and Programs with less stringent requirements.

The following are suggestions to be included into the policy document to ensure CM Program effectiveness:

1. The responsibility for managing the overall MSFC CM Program for Institution.
2. The roles and responsibilities for the related organizations at MSFC for the Institutional CM Program.
3. The identification of the approval authority for changes to the configuration.
4. The recordkeeping requirements.

AREAS FOR IMPROVEMENT: None.

FURTHER REVIEW BY: SMA INTERNAL X CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA15

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Arthur Lee

DESCRIPTION OF PROCESS: A Centerwide policy needs to be in place to define the Center's Management position on deviating/waiving from either Center, Agency, or especially OSHA Standards. The policy should also include, but not limited to, a discussion on the level of required approval for deviating or waiving from the various standards, codes, regulations, and instructions. This may require Center Director approval to understand the safety and risk acceptance to the overall Center's programs, resulting from the deviation/waiver.

STRENGTHS: There is a "Variance" Policy in the draft MSFC Procedures and Guidelines (MPG) 1700.1, Section 1-11 which describes the Industrial Safety Office (ISO) has to approve of any variances to the industrial safety requirements. Also, this section has a discussion on the level of approval required for NASA safety standards and instructions as well as Federal regulations.

It should be noted that the draft MSFC Safety Manual include safety programs for Lifting Devices and Equipment (LDE), Pressure Vessels and Pressurized System (PV/S), Explosive Devices and Materials, etc. The current draft MPG 1700.1 states that any variances of these Programs only requires approval by the ISO at MSFC.

BARRIERS: There needs to be a written MSFC policy for deviation/waiver to define Center's Management position on the deviation/waiver of either MSFC, NASA, or Federal standards and regulations. This document should include, but not be limited to, a discussion on the applicability Centerwide, level of approval required, specific MSFC programs of concern, and require data submittal for approval.

AREAS FOR IMPROVEMENT: None.

FURTHER REVIEW BY: SMA INTERNAL X CENTER ENTERPRISE NONE

PROCESS VERIFICATION EVALUATION SHEET

MSOFA16

DATE OF REVIEW: December 3, 1997 **FACILITY:** Marshall Space Flight Center (MSFC)

PV AREA: Functional Assurance

TEAM MEMBER: Arthur Lee

DESCRIPTION OF PROCESS: Since the NASA Headquarters SRM&QA Survey at MSFC dated March 30, 1990 was performed, MSFC had developed a specific written policy/procedure for identification of MSFC critical lifts. This policy was promulgated on November 9, 1994 to comply with NSS/GO-1740.9B, "Safety Standard for Lifting Devices and Equipment (LDE)."

From the previous NASA Headquarters' Functional Management Review (FMR) Spot Check performed by Code QS in July 1995, a draft MSFC Management Instruction (MMI) for the entire lifting devices and equipment program had been prepared at the time to address the NSS/GO-1740.9B compliance requirements. This document had been distributed to the various MSFC organizations that were responsible for LDE for review and comments.

It was recommended to have the MMI for LDE finalized and approved as soon as possible in order to formally baseline and implement MSFC program. Due to changes and consolidations of the MMIs for the various safety programs at MSFC, the MMI for LDE was never approved by the Center. This draft document is currently being incorporated into a section of the overall draft MSFC Safety Manual, MSFC Procedures and Guidance (MPG) 1700.1.

As of October 1997, EG&G has just taken over as the support contractor for LDE Program at MSFC with the Facilities Office (Code AB01) being responsible for program management. Previously, the BAMSI (Brown & Associates Management Services, Inc.) support contractor was responsible for the overall Centerwide cranes and lifting devices which include the testing, inspecting, and maintaining lifting devices and materials equipment. BAMSI subcontracted to an off-site contractor, Global Crane Institute, in performing the inspections, certifications, and recertification of lifting cranes and hoists to ensure compliance with ANSI and OSHA. The overall handling and operating of the overhead and mobile cranes at MSFC was being performed by BAMSI where BAMSI provided a comprehensive training and certification for all BAMSI crane operators. Although BAMSI operates the mobile cranes, the Transportation Systems Office (Code CN) provided for the maintenance and certification of the mobile cranes. For all new Construction of Facilities (CoF) projects that involve lifting cranes and devices, the program manager for that specific project was responsible for the full compliance of all NASA and MSFC safety related standards. The Industrial Safety Office (ISO) provided for the overall MSFC safety program for lifting devices and equipment with technical staff support by Hernandez Engineering, Inc. (HEI).

Based on the review of MPG 1700.1, Section 5-3 for Lifting and Handling, the NASA policy is that any "deviation/waiver" of a NASA Standard requires NASA Headquarters' approval. This needs to be corrected.

Upon review of the NASA policy for LDE, the policy for "Personnel Working Under Suspended Loads" at MSFC needs to be included in the MPG 1700.1 to eliminate any questions on this matter.

MSFC needs to finalize MPG 1700.1, Section 5-3 for lifting and handling as soon as possible to reflect the most current MSFC safety program for lifting devices.

FURTHER REVIEW BY: SMA INTERNAL X CENTER ENTERPRISE NONE